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*On the Life-History and habits of the moth Duomitus leuconotus, Walker in Calcutta.*—By E. P. STEBBING.

[Read 4th November, 1903.]<sup>1</sup>

I propose in this paper to make a few remarks upon the life history of a moth, by name *Duomitus leuconotus*, Wlk. about whose larval and pupal stages little would appear to have been observed or placed upon record.

*Duomitus leuconotus* is one of the wood-boring moths belonging to the family *Cossidæ*. Turning to Hampson's Moths in Blanford's Fauna of British India we find that but six genera of this family are at present known in India: *Cossus*, *Duomitus*, *Azygophleps*, *Eremocossus*, *Phragmatæcia*, and *Zeuzera*. This paucity in the known genera of the family is carried into the described species of which a list of but twenty-three are known, the numbers per family being as follows: *Cossus* 6, *Duomitus* 6, *Azygophleps* 3, *Zeuzera* 5, *Phragmatæcia* 2, and *Eremocossus* 1. About the habits of the majority of these species little is known. It is probable that most of, if not all, the larvæ live and feed in the wood of trees, and some of them may spend several years in this manner before changing to pupæ. In most instances, however, neither the larvæ nor

<sup>1</sup> Publication delayed by proofs having to be sent to England.

pupæ have yet been discovered and described. While, however, this is the rule in the family, there are two notable exceptions, in each of these cases the insects being of economic importance. *Duomitus niger*, an insect closely allied to the species we are considering in this paper, is the moth whose larva is known as the 'Black Borer' of Coffee-planters, and has proved a source of considerable loss on Coffee estates, whilst *Zeuzera coffeæ*, the moth whose larva is known as the Red-Borer (called by Hampson White-Borer<sup>1</sup>), commits great destruction in Southern India and is a pest well-known to Coffee-planters. The life-histories and habits of these two insects are more or less well known. Of the other representatives of the family in the Indian Region we have, however, little on record save the descriptions of the moth, in some cases both the ♂ and ♀ of a species having been described, in others the description of the ♂ or the ♀ only being extant. During the last few months I have had an opportunity here in Calcutta of working out a portion of the life-history of one of the other known species of *Duomitus*, that bearing the name of *D. leuconotus*, Walker, and my observations are recorded below.

The moth of which descriptions of both male and female are given by Hampson in the Fauna is a large, stout, striking-looking insect with a white thorax and greyish mottled wings. Hampson gives the wing expanse in the ♂ as varying from 98-128 millim, that of the ♀ being given as 180 millims. The specimens obtained by me this year show that there is a very much greater variation in size in both sexes. The following dimensions of 32 moths all taken from the same tree are, I think, well worthy of being placed upon record :—

Expanse of wings in ♂				Expanse of wings in ♀			
80 millims	...	...	...	...	116 millims.		
110	"	...	...	...	88	"	
108	"	...	...	...	88	"	
90	"	...	...	...	77	"	
83	"	...	...	...	100	"	
78	"	...	...	...	100	"	
90	"	...	...	...	115	"	
95	"	...	...	...	98	"	
82	"	...	...	...	84	"	
73	"	...	...	...	96	"	

<sup>1</sup> The real 'White Borer' is the larva of a *Cerambyx* beetle. *Vide* my 'Note on the Sandal wood boring insects of Madras' published in the Appendix Series of the *Indian Forester*, Vol. XXIX, No. 7 (1903).

Expanse of wings in ♂				Expanse of wings in ♀			
70	millims	...	...	...	108	millims.	
85	"	...	...	...	125	"	
74	"	...	...	...	80	"	
99	"	...	...	...	120	"	
72	"	...	...	...	80	"	
70	"	...	...	...	85	"	
♂—70 to 110	"	...	...	♀—77 to 125	"		

The above figures show the very great variation in size to be found in both sexes.

Neither larva nor pupa appear to have been previously described.

*Larva* (almost half-grown).—General tint, a dark flesh colour with brown head, yellow prothoracic segment edged in front with black with a few black specks behind; canary-yellow mesothorax and flesh-coloured metathorax. Following eight segments are flesh-coloured, lighter at junction of segments. Last segment is canary-yellow, becoming orange-yellow at extremity.

The head is dark chestnut-brown anteriorly, shining, chitinous, ovate, and large; mouth parts black, antennæ short, 3-jointed, yellow-brown. Posteriorly head shades off into pale-brown and yellow. It is followed by a large prothoracic shield which is hard and chitinous and shining, slightly convex. The chitin terminates at the sides, the under-surface of prothorax being canary-yellow in colour and soft. The large chitinous shield is ovate, anterior margin straight, posterior ovate, elliptical. At the posterior edge of the thoracic plate is an elliptical circle of small raised spikes or spade-like protruberances, doubtless used to shovel out of the way wood refuse and perhaps for scraping purposes. They are set backwards and are club-shaped. Behind these are a number of minute black spots placed in a crescent-shaped manner on the mesothorax, the angles pointing forwards. The mesothorax is much narrower and smaller and with a quite soft skin. The following segments are equal in size, about a third less in diameter than the prothorax, and have a few scattered black tubercles on them, each bearing a thin white hair. The last segment tapers to a blunt point.

Mouth parts pale-yellow beneath. Thorax beneath dark canary-yellow and rest of segments dark-yellow. Thoracic legs canary-yellow, pro-legs dark-yellow, flat and thick. Length  $1\frac{1}{4}$  inch.

*Pupa*.—Sub-cylindrical, stout. Dark chestnut-brown to almost black. Black ventrally. Segmental bands orange, as also is front of thorax. Wing covers, eyes, antennæ and legs well marked on outer

covering. Stigmata black with a circular orange edging. Nine dorsal segments plainly visible, and 5 ventral ones.

Length 2 to  $2\frac{1}{4}$  inches. Size very variable.

The moths appear on the wing in the latter half of September, and are to be found during the remainder of that month and on up to about the third week in October. They are extremely sluggish during the daytime, but are powerful fliers at night. In the day they are to be found clinging to the bark of trees which their general colouration greatly resembles, thus serving to protect them from the attacks of enemies. The male lives but a few days and dies after pairing with the female. The latter lays her eggs, which are small, yellowish and deposited in irregular-shaped masses stuck together with some siccable material upon the bark of trees. She dies as soon as she has finished ovipositing. Examination of attacked trees has shown that these eggs are laid anywhere upon the woody parts of the tree, and that the young larvæ on hatching out bore straight through the bark to the sap-wood and feed in this for a time, subsequently going into the hard wood of the stem or branch. The mortality amongst the young larvæ must be very high since it would be quite impossible for any one tree to support the large number of larvæ the eggs of a single moth gives rise to, it being remembered that almost the whole of this stage is spent feeding in the wood. The larva almost certainly spends not less than two years feeding in the wood of the tree. The evidence for this assertion was found in the case of a tree which had practically been killed by the insects. Mature pupæ and moths were taken from this tree and also two half-grown (or less) larvæ. Since the moths only issue in September-October it is evident that these larvæ hatched from eggs laid at the very latest in the year before.

The larva bores in an irregular manner in the wood, the tunnel having apparently no regular or definite direction. The tunnel increases in diameter with the growth of the grub, finally measuring over half an inch across. It is packed with the wood sawdust and excreta of the larva. When fullgrown the larva carries its tunnel to the outside, boring a hole through the bark, and this hole will be observable on the outside owing to the fresh sawdust to be seen just below it on the bark of the tree. Having thus prepared an exit, the caterpillar larva backs down its tunnel for a distance of 2-3 inches (this space being kept quite free of wood particles) and spins a stout web-like series of strands of a coarse yellowish-brown silk across and below the mouth, thus effectually preventing any intruder, entering the tunnel from outside, getting near it. The larva then pupates. These strands of coarse brown silk are very characteristic of the pupation of this *Duomitus*. The pupal stage is



probably a short one—at the most from six weeks to two months. Pupæ were found fully mature and also but newly changed from larvæ early in September, but they had all issued by the end of the third week in the following month. The hole bored to the outside by the larva is more or less vertical, only inclining to the horizontal just near the bark, so that the pupa, when the moth is ready to emerge, creeps up the tunnel and projects from it at an angle at right angles to the stem of the tree. In doing this the pupa bends over at an angle, the upper half being almost horizontal, whilst the lower portion remains in the almost perpendicular tunnel. The pupal skin then splits down at its anterior end both dorsally and ventrally as far as the posterior edge of the last thoracic segments and the moth crawls out. In the cleavage the head and antennal covering comes away as one piece.

It has been said that the larvæ live in the wood of living trees, and observations have shown that they will desert trees which have been cut down and the wood of which has consequently begun to dry. On the 22nd September of this year my attention was drawn to a small *Cassia nodosa* in the Indian Museum compound, which was evidently in a dying condition, the spring crop of leaves having all dropped and no new ones having replaced them. Examination showed that the tree was infested by this moth, several holes with half-protruding empty pupal cases being perceivable. The tree was but 15 feet high with a girth of twenty inches at the base. It was much branched all the way up and had a whippy spreading crown. I had this tree cut down and placed in a large wire gauze cage. In addition to two half (or less) grown larvæ and some live pupæ (taken to preserve in spirits) the following moths were obtained from the stem as they issued on the dates noted. [A portion of this stem, with the empty pupal cases *in situ* protruding from the bark, is now exhibited in the Insect Pest Gallery at the Museum; the other half will be sent to the British Museum.]

Date of issue.				♂	♀
22nd	September,	1903	...	...	1
23rd	"	"	...	...	2
24th	"	"	...	...	3
25th	"	"	...	...	1
26th	"	"	...	...	2
27th	"	"	...	...	1
29th	"	"	...	...	4
30th	"	"	...	...	3
3rd	October,	"	...	...	2
4th	"	"	...	...	2

Date of issue.				♂	♀
8th	October,	1903	...	...	2
10th	"	"	...	...	1
16th	"	"	...	...	1
Total				...	16
					16 = 32 moths.

In addition to these 32 moths there were two others which never acquired their proper wings on issuing, probably due to the handling the chrysalids received. It is probable that at least 40 moths left this tree during September and October.

In addition to the small *Cassia nodosa* tree, which may be said to have been killed by this insect during the present year, a much larger tree some 35 feet high and three feet in girth has been attacked, more especially at its base, as evidenced by several empty pupal cases protruding from the bark surface.

The moth was noticed in various parts of Calcutta during the above-mentioned weeks, and was evidently this year fairly abundant. We have yet to discover what other trees it infests in addition to the *Cassia nodosa* which Major Prain, who very kindly identified the tree for me, tells me was originally sent to the Museum from the Royal Botanic Gardens at Sibpur.

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*The Cyclone in the Bay of Bengal, between the 13th and 15th November, 1903.*—By C. LITTLE, Esq.

With four plates.

[Read 2nd March, 1904.]<sup>1</sup>

In the early days of meteorological study in India, a first place was naturally given to the cyclone, and numerous discussions of more or less remarkable examples of cyclonic storms are on record. Piddington, Blanford, Wilson, Pedler, and last but not least, Sir J. Eliot have added to that record, of which a summary may be found in the Handbook of cyclonic storms by the last-named. A reference to the original memoirs will show that the investigators, at all events the later ones, overlooked not the smallest details, with the result that these details almost appear to be the main object of the discussion. But that had carried with it its own cure. Now it is recognised that many

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